

# The Emerald 6.6kW Li-Ion Battery Charger™ for E-Mobility

## Description:

Green Watt/Powerland's new Emerald Charger™ with internal liquid cooling capability is the smallest 6.6kW Li-ion battery available designed with ultra-high-power density and a metal case enclosure. The excellent power efficiency and thermal management provide the on-board standard charger's high reliability and long lifetime. This series of chargers offer solid and safe power conversion for E-Mobility applications such as e-vehicles, e-bus, e-boat, etc.

## Features:

- AC Input: 90-132Vac & 175-264Vac
- Output Power: 6.6kW
- 298x188x70 mm (11.7x7.4x2.8")
- Internal Liquid Cooling
- High Efficiency: 95% Typical
- All-Around Protections: OVP, OCP, SCP, OTP, UVLO
- Low Temperature Start Up @ -40°C
- High Temperature Full Load Operation with 65°C Coolant
- IP67 Ingress Grade
- Communication via CAN Bus
- J1772 option
- Parallelable operation supported

Model Number	J1772	Cooling	Output Power	Output Voltage	Output Current Range
EVC-420-6600-J1772-LJ (PLD6600-EVCS51-420J)*	Yes	Liquid	6600W	220-420V	1-20A
EVC-420-6600-L (PLD6600-EVCS51-420)*	No	Liquid	6600W	220-420V	1-20A

NOTE: Model #'s in parenthesis are factory part numbers

Input/Output Specifications	
Input Voltage	90~264v
Input Frequency	47-63Hz
Max. Input Current	32Arms
Max. Input Power	7180W
Input Current THD	3%
AC Line Inrush Current	50A
Output Voltage	220-420V
Output Voltage (LV)	13.8Vdc (min), 16Vdc (max) @2A max
Current Ripple	±10% Io max.*
Voltage Ripple:	±2% Vo max.*
Output Voltage Precision	±0.5% @ 115Vac & 230Vac, 25°C
Output Current Precision	0.4A @ 115Vac & 230Vac, 25°C, full load
Output Current (150-220VDC)	1A min.
Output Current (220-420VDC)	2~20A
Current Accuracy	±0.3A

Voltage Accuracy	±0.5%
Output Power @ Vin 90-132Vac	3300W
Output Power @ Vin 175-245Vac	6600W
Efficiency (Up to)	95%
Power Factor (Typical)	0.99 @ ≥4.4kw load
Ingress Protection	IP67 for enclosure (without fan)

\* with typical Battery load at 25°C 115Vac & 230Vac input, measured at 20MHz bandwidth

<b>General Specifications</b>			
Input Over-voltage Protection	When the input terminal voltage exceeds 270V±4VAC, output turns off and alarm is reported through the bus. When the input voltage is lower than 260V±4VAC and lasts for 5s, normal operation is resumed, and alarm stops.		
Output Short Circuit Protection	Before starting, if the output is short-circuited, it shall not startup and will give an alarm after receiving the work instruction. After troubleshooting, the on-board charger shall work properly. In the case of short circuit during the operation, the output shall be off and alarm shall be reported.		
Input Over-current Protection	In the case when input current exceeds the limit of allowable working current by 10% and lasts for 3 seconds, the charger shall conduct derating work. When the duration exceeds 30s, the working current still fails to fall below the limit, and the charger shall stop working with fault storage and fault reporting. In the case when input current exceeds the limit of allowable working current by 50% and lasts for 0.5s, the charger shall conduct derating work. When the duration exceeds 5s, the working current still fails to fall below the limit, and the charger shall stop working with fault storage and fault reporting.		
Output Current-limiting Protection	Monitor the current at the output end. When the current at the output end exceeds the design output current threshold of 25A, the charger shall cut off the load at the output end in time to prevent damage to the load.		
Output Under Voltage Protection	When the output voltage is lower than 140V±4V DC, the charger shall stop working and alarm is reported through the bus.		
Output Over Voltage Protection	When the output voltage is higher than 460V±4V DC, the charger shall stop working and alarm is reported through the bus. (This condition is extremely abnormal, preventing the over-charge of the over-charged battery.)		
Over Temperature Protection	When the internal temperature of the charger exceeds 75°C output current shall start derating.		
Anti-Reverse Polarity Protection	When the battery polarity is reversely connected to the charger, the charger will not output.		
Input Under-voltage Protection	When the input voltage is lower than 80V±4V AC, the output turns off and alarm is reported through the bus. When the input voltage is higher than 90V±4V AC and continues for 5s, it shall return to normal operation and stop the alarm.		
CAN Communication Fault Protection	In the case that the charger does not receive BMS instructions for 5 seconds, the charger immediately stops working and reports CAN communication fault. When CAN bus is restored and stable for 5 seconds, it shall respond to operation instructions.		
Turn on delay	< 5sec @ 115Vac & 230Vac, 25°C, full load		
Product Life: 25°C, 230Vac input, and full load output.	≥ 5 years		
Temperature – Operating coolant	MIN MAX	-40 +65	°C
Temperature – Operating ambient with controlled coolant temp	MIN MAX	-40 +85	°C

Temperature - Storage	MIN MAX	-50 +85	°C
Relative Humidity	0% to 95% RH (non-condensing)		
Case Size	~298x188x70 mm (11.7x7.4x2.8") (main case, no connectors/water inlet)		
Unit Weight	~6kg		

<b>Electromagnetic Compatibility EMI/EMC</b>	
<b>EMI, RFI</b>	Comply with ECE R10 and CISPR 25 Class C, shall have a minimum of 3dB margin.
<b>Immunity (Designed to meet):</b>	
EN61000-3-2	Harmonic Current Emission
EN61000-3-3	Voltage Fluctuations and Flicker
ISO10605	ESD 8kV Air Discharge, 4kV Contact Discharge
ISO11452-2、ISO11452-8	Radio-Frequency Electromagnetic Field Susceptibility Test-Rs
EN61000-4-4	Electrical Fast Transient/Burst – EFD
ISO7637-3	Immunity to Inductive/Capacitive Coupled Transients
ISO11452-4	Immunity to bulk current injection – BCI
EN61000-4-5	Surge Immunity Test, AC power line: line to line 2kV, line to earth 4kV
ISO7637-2、ISO11452-2	Conducted Radio Frequency Disturbance Test-Cs
ISO11452-8 Class A	Power Frequency Magnetic Field Test
EN61000-4-11	Voltage Dips

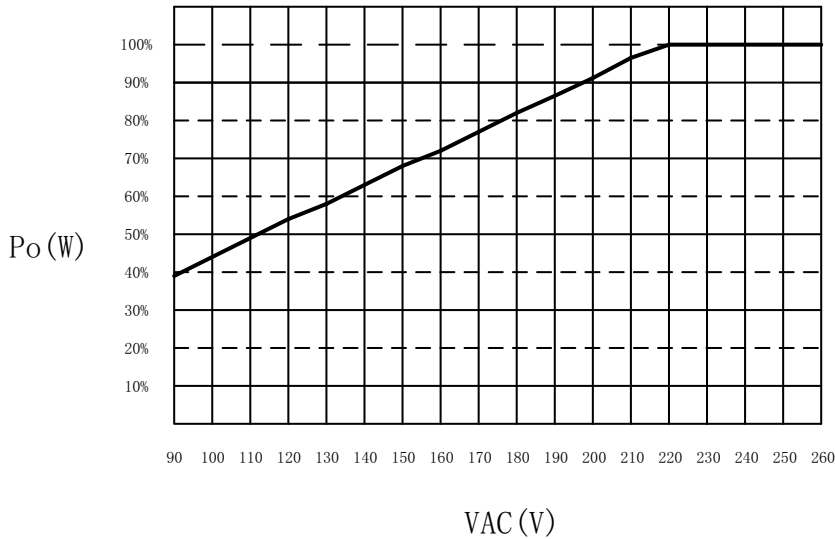
Notes: Specification is subject to change without notice.

### Cooling Mode

The Charger needs to be water cooled with the following specs:

Parameter	Value
Coolant inlet temperature	<65°C
Flow rate	12~25L/min
Pressure Loss	Curve TBD
Inlet and outlet coolant pipe	¾ ~ ½ inch (It can vary to optimize the vehicle cooling system)
Max operating pressure without leak	1.2 bar
Burst Pressure without leak	2.0 bar

### Derating Curve



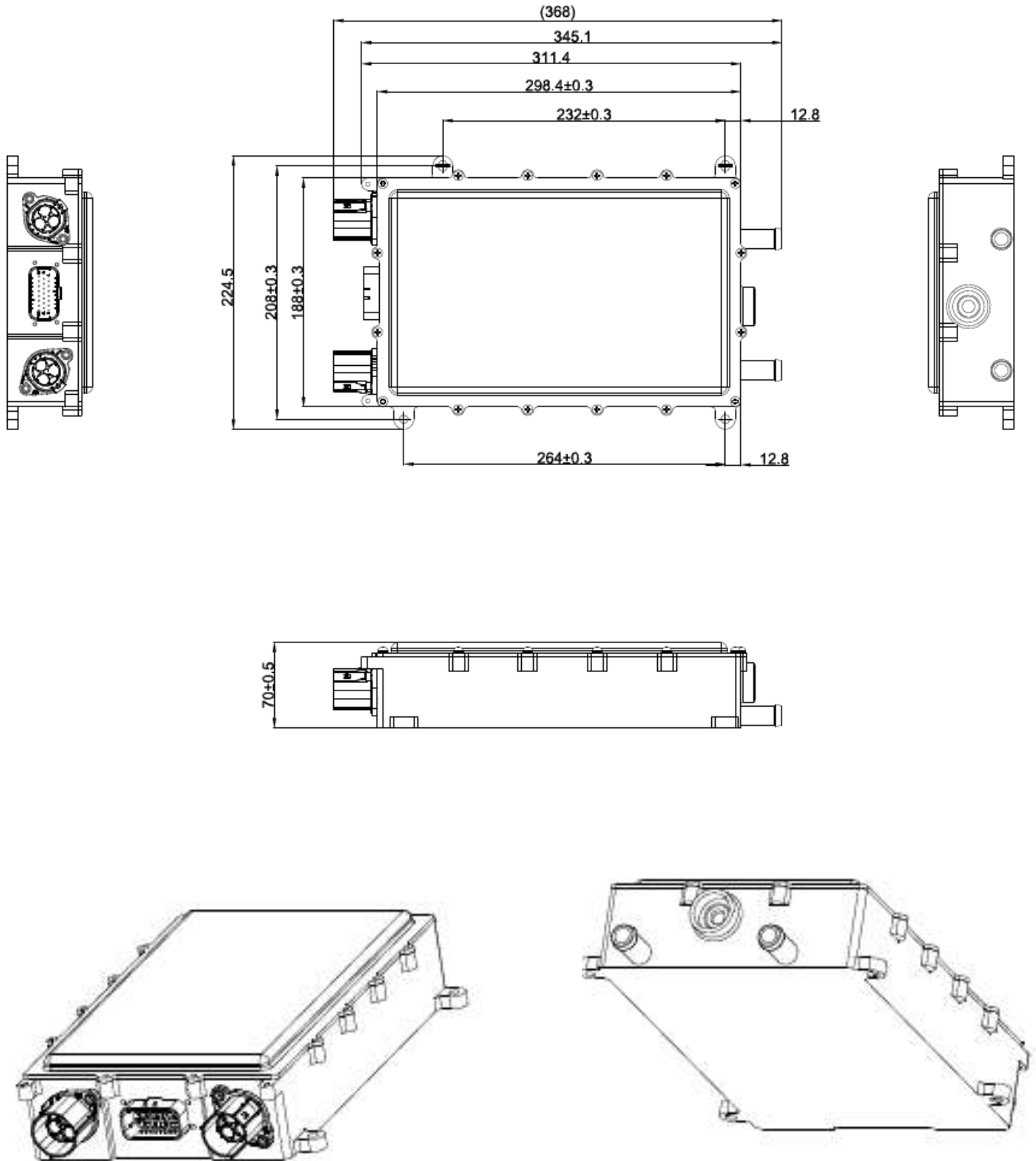
### Charge Curve:



The charging current will be limited to ensure charger power will not exceed 6.6KW. The charge curve is an example under 230Vac input and 25°C ambient temperature. The charge curve will be different if different AC input current. The coolant and ambient temperature will also influence the charging power to ensure the internal components will not exceed its safe operation range.

**Mechanical Information: Liquid Cooled Version**

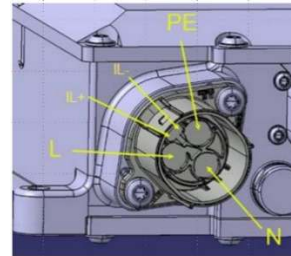
Dimensions mm



## Connector Info: All Connectors:

### AC Input Connector

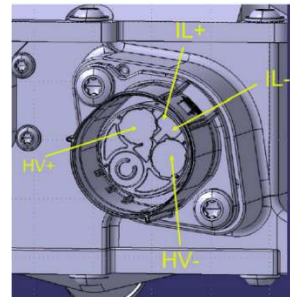
Pin Definition	Symbol
AC Input – Live	L
Protective Earth	PE
AC Input - Neutral	N
HVIL +	HVIL +
HVIL -	HVIL -



HV AC Connector TE Connectivity, HVA-HD400-3P family, #2371113-3

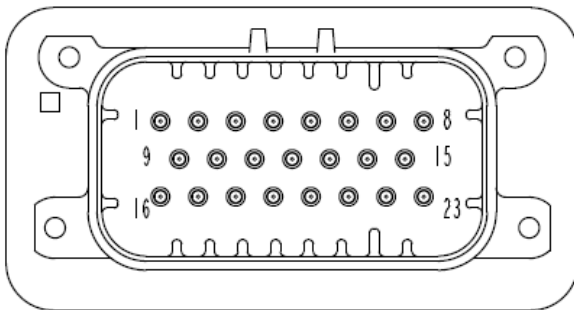
### DC Output Connector

Pin Definition	Symbol
Voltage Positive	Vout +
Voltage Negative	Vout -
HVIL +	HVIL +
HVIL -	HVIL -



HV DC Connector TE Connectivity, HVA-HD400-2P family, #2-2371113-1

### Vehicle Interface Connector and description:



TE Connectivity, AMPSEAL Family:  
776087-4 or 776087-4  
Key Location as Shown

	Signal Name	Remark
1	CAN-H Communication	CAN-H
2	CAN-H Communication	CAN-H
3	Future	NC
4	Future	NC
5	Future	NC
6	Future	NC
7	CAN Identification	CAN ID
8	GND (should be connected to vehicle ground)	GND
9	CAN-L Communication	CAN-L
10	CAN-L Communication	CAN-L
11	Future	NC
12	Future	NC
13	Future	NC
14	HV Interlock +	IL+
15	HV Interlock -	IL-
16	Proximity pilot	PP
17	Control pilot signaling	CP
18	PE	PE
19	Future	NC
20	Future	NC
21	Future	NC
22	Future	NC
23	12-volt supply IN/OUT	AUX

## **Regulatory**

### **Insulation and Safety Standards**

#### **Insulation Resistance**

10M ohm. @voltage of 500 Vdc to the charger for 60s/500Vdc

#### **HI-Pot**

AC socket to Chassis: 3.0kVac,10mA.

AC socket to DC output: 3.0kVac,10mA.

## **Electromagnetic Compatibility**

### **EMI/EMC Requirements**

IEC CISPR 25:2016 Class3

## **Voltage Surge Test**

AC power line: line to line 2kV; line to earth 4kV

## **Electrostatic discharge**

ESD 8kV air discharge, 4kV contact discharge

## **Communication**

### **CAN Communication/CAN**

#### **CAN Bus – Standards compliance/CAN**

- ISO11898-1:2015 - Controller area network - Part 1: Data link layer and physical signaling
- ISO11898-2:2016 - Controller area network - Part 2: High-speed medium access unit
- ISO11898-3:2006 - Controller area network - Part 3: Low-speed, fault-tolerant, medium-dependent interface
- ISO11898-4:2006 - Controller area network - Part 4: Time-triggered communication

#### **CAN Bus – Baudrate: 500kbds**

#### **CAN bus – UDS Protocol: the OBC supports the UDS function**

## **Bootloader is provided with Charger**

The OBC is designed with a Bootloader function, allowing it to be re-flashed in the field.

- Support at least 1000 reflashes
- Erase function shall erase all memory blocks
- Reflash effective speed: 12Kbytes/s

## **J1772 Protocol/J1772**

### **Control Pilot Circuit**

The OBC shall have a control pilot circuit according to SAEJ1772:2010

### **Proximity Detection Circuit**

The OBC shall have a Proximity Detection Circuit according to SAEJ1772:2010